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THE EFFECTS
OF BOMBING PETROLEUM STORAGE TERMINALS
IN NORTH VIETNAM SINCE 28 JUNE:
A PRELIMINARY ANALYSIS

DIA DECLASSIFICATION/RELEASE INSTRUCTIONS ON FILE

10 JULY 1966

GROUP 1
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THE EFFECTS
OF BOMBING PETROLEUM STORAGE TERMINALS
IN NORTH VIETNAM SINCE 28 JUNE:
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Summary

Attacks on North Vietnamese petroleum storage facilities have made continued operation of the economy and prosecution of the war in the south more difficult and costly. Bombing which began on 29 June has denied North Vietnam: (a) nearly 50 percent of the pre-raid capacity in principal bulk petroleum storage facilities; (b) the use of certain of the facilities at Haiphong, the only important terminal for receiving ocean-going tankers; (c) the use of the entire Hanoi facility, the country's second largest petroleum storage center and most important hub for internal distribution; and (d) some 50 to 60 thousand tons of petroleum products.

Sufficient petroleum storage capacity and stocks remain, however, to permit both civil and military operations -- including infiltration -- to continue for more than 5 months at the estimated level of 1 April 1966. Additional imports of petroleum and reduced use of petroleum by non-essential consumers would extend this period.

As long as the jetties and some storage capacity remain at Haiphong, some use of this terminal is possible. To the

* This memorandum was produced by the Office of Research and Reports and coordinated with the Offices of Current Intelligence and National Estimates and the Special Assistant to the Director for Vietnamese Affairs; the estimates and conclusions represent the best judgment of the Directorate of Intelligence as of 10 July 1966.

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extent that sufficient supplies cannot be imported through Haiphong, other means of distribution can be employed, including, principally, delivery to South China and transport from there by rail, truck, or coastal shipping to the remaining storage sites in North Vietnam.

SECRET1. Overall Effectsa. Losses to North Vietnam

The bombing which began on 29 June resulted in the loss of nearly one-half of the total capacity (165,000 tons*) at the principal petroleum storage terminals in North Vietnam (see the table and the map). The North Vietnamese not only suffered the loss of about 77,000 tons of storage capacity, but also are now denied the full use of the facilities at Haiphong, the only import terminal for oceangoing tankers, and Hanoi, the largest and most versatile terminal in North Vietnam for internal storage and distribution. Moreover, some 50,000 to 60,000 tons of petroleum products, with an estimated value of US \$1 million to \$1.5 million, ** probably were destroyed. This loss of petroleum represents about 100 to 120 days' supply at consumption rates estimated for North Vietnam as of 1 April 1966.

The extent to which the damaged Haiphong facility cannot accept deliveries of petroleum from oceangoing tankers will determine the need to switch to such alternative import procedures as (1) delivery by tanker to China and thence by rail, (2) import of petroleum in drums on cargo ships, or (3) delivery by rail direct from the USSR through Communist China. Substitute procedures will increase significantly the unit cost of petroleum imports. Moreover, North Vietnam must now accept higher costs for internal distribution of petroleum resulting from the loss of certain bulk storage facilities and the consequent need for increased internal distribution in drums and other small containers.

b. Residual Capacity

Despite the serious loss of property, equipment, and petroleum, North Vietnam has sufficient petroleum facilities and supplies to maintain its economy at an adequate level, although at greater cost than before the bombings. Approximately 88,000 tons of bulk storage capacity at principal storage sites remains undamaged. Moreover, dispersed petroleum storage capacity had been prepared, presumably in anticipation of bombing.

* Metric tons are used throughout this memorandum.

** Based on the price of gasoline and diesel fuel oil f. o. b. Singapore.

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Storage capacity and stocks of petroleum remaining after the raids is estimated as follows:

Storage Sites	Storage Capacity (Tons)	Inventory a/ (Tons)
Principal storage sites	88,000	66,000
Small dispersed storage sites	10,000 b/	7,500
Storage at airbases and at other military sites	6,300	4,700
Total	<u>104,300</u>	<u>78,200</u>

a. Tanks are estimated to be 75 percent full on the average.
b. Based on the fact that not all of the identified sites, having an estimated total potential capacity of about 12,000 tons, are completed or filled and a few of the sites have been damaged by armed reconnaissance strikes.

In addition to these stocks, there are in the possession of consumers, both military and civil, an indeterminate but presumably large number of 55-gallon drums, some of which undoubtedly are filled. North Vietnam also has access to additional supplies from

- (1) 10,000 tons of diesel fuel aboard the Leningrad, which was diverted to Shanghai prior to the bombing, and
- (2) 10,000 tons of gasoline and diesel fuel (in approximately equal quantities) aboard the Kostroma, which was moved to Fort Bayard in South China after the bombing.

Disposition of the cargo remaining aboard the Komsomol, which was at Haiphong prior to the bombing, is not known. The Komsomol was reported to have departed Haiphong on 5 July for Vladivostok.

The inventory shown in the above tabulation -- 78,200 tons -- represents an estimated total of 156 days of supply in North Vietnam. These days of supplies are based on the consumption rate of 500 tons

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North Vietnam: Capacity of Principal Petroleum Storage Installations
 as of 28 June and 9 July 1966
 and Percent of Capacity Destroyed or Damaged as of 9 July 1966

<u>Location</u>	<u>Storage Capacity (Thousand Metric Tons)</u>		<u>Percent of Capacity Destroyed or Damaged</u>
	<u>As of 28 June</u>	<u>As of 9 July</u>	
Haiphong	72	38	47
Hanoi	34	0	100
Vinh a/	2	2	0
Nguyen Khe	13	10.4	20
Phuc Yen a/	14	14	0
Bac Giang	6	3.6	40
Do Son	4	0	100
Viet Tri	4	4	0
Phu Qui a/	2	2	0
Duong Nham	14	14	0
Total	<u>165</u>	<u>88</u>	47

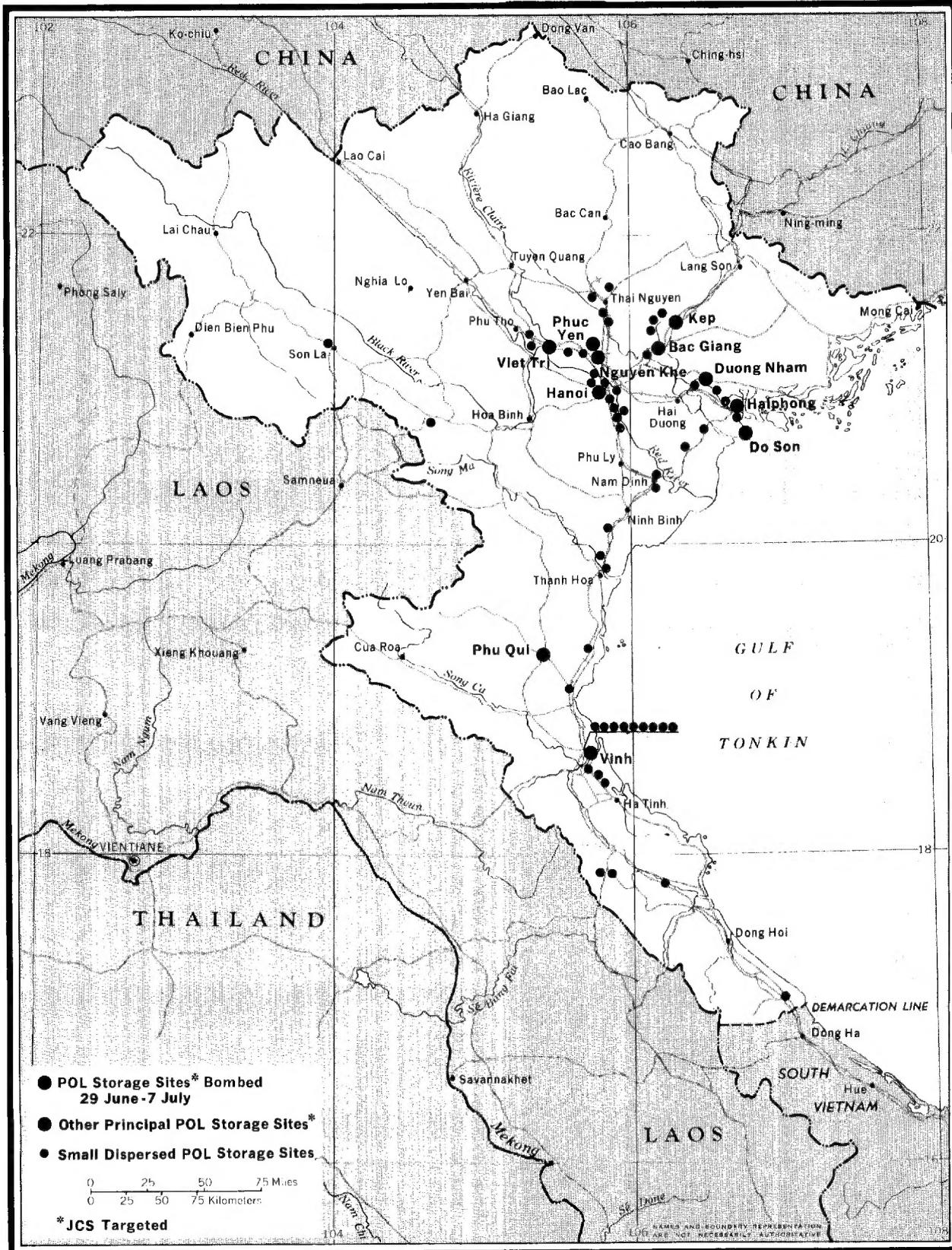
a. Not attacked in the June/July bombings.

per day estimated for the level of activity as of 1 April 1966. Of this total, about one-half is required to support military operations, including support of infiltration through the Laos corridor. North Vietnam could eliminate or reduce certain less essential petroleum uses and thereby sustain military and civil activities for a significantly longer period.

Considering the small absolute demand for petroleum, the volume of supplies which survived the bombings, and the alternative possibilities for imports, it is concluded that North Vietnam will have adequate supplies to permit continued operation of the economy and prosecution of the war in the south. The bombing, however, has created additional problems of supply and has imposed higher costs.

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2. Possible Alternative Import, Storage, and Distribution Measures

The remaining bulk petroleum storage capacity, described above, can be used to accept imports delivered by tanker or by rail tank car.

a. If, as now appears probable, some tanks and the oil jetties at the Haiphong terminal are usable, and temporary piping and portable pumps could be installed, tankers could discharge cargoes into the remaining tanks, or, through the tanks, into rail tank cars. Alternatively, tankers could discharge in the outer harbor into barges which could proceed to the jetty at Haiphong for discharge, or to any other storage point where bulk deliveries could be accepted.*

b. Tankers with cargoes destined for Vietnam could discharge at alternative ports in China, such as Fort Bayard or Shanghai, and the petroleum could then be transshipped by rail to Vietnam. A standard-gauge railroad runs from Fort Bayard via Li-tang to P'ing-hsiang on the China/Vietnam border. The capacity of this line is more than 6,000 tons per day, or more than 10 times the estimated North Vietnamese requirement of 500 tons of petroleum per day. The number of tank cars required in continuous use to move the tonnage would be about 1 percent of the current inventory of tank cars in Communist China. At P'ing-hsiang, China, near the North Vietnamese border, all tonnages must be transloaded from the Chinese standard-gauge to the North Vietnamese meter-gauge railroad. The meter-gauge railroad from the border to Hanoi via Lang Son has a daily capacity of at least 3,000 tons, or more than six times the estimated requirement for petroleum. There is a petroleum storage facility at P'ing-hsiang with a capacity of about 2,000 tons, and this installation could be used to even out the flow of petroleum traffic on the railroad. North Vietnam has about 200 tank cars and might have access to at least 150 of the meter-gauge Chinese tank cars formerly used in the transit trade through North Vietnam.

c. North Vietnam has been developing a widely dispersed system of bulk petroleum storage installations in anticipation of the possible loss of its principal storage terminals. These dispersed installations consist of varying numbers of small cylindrical tanks, each having a capacity of 8 to 11 tons, which are placed in excavations and covered with earth for hardening and concealment. As of 30 June, about 50 such installations, with an estimated total potential capacity of about 12,000 tons, had been

* Six oil barges of indeterminate capacity have recently been observed unloading tankers in the outer harbor.

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identified as completed or under construction (see the map). Approximately 30 sites are located north of the 20° parallel, which would include Hanoi and Haiphong and the heavy concentration of the rail net including the Dong Dang - Hanoi - Lao Cai system. Moreover, many of the sites are located on or near this rail system. The pattern of the location of these sites will facilitate their resupply by rail through China. A few of these very-small-capacity installations have been attacked by armed reconnaissance in recent weeks, but no estimates of damage are available.

d. If North Vietnam is prepared to accept the risk of future bombings, new oil storage tanks might be built in the vicinity of Haiphong. The USSR has developed pre-fabricated oil storage tanks which are delivered in a coil and which probably could be shipped to North Vietnam and erected within 60 days. The USSR also has developed portable pipelines, complete with pumps, which probably could be made available for use with the pre-fabricated tanks to provide a whole new storage and distribution system for Vietnam. Apart from the question of vulnerability to re-attack, however, it is unlikely that North Vietnam would replace all the tankage that existed at Haiphong.

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3. Damage to Individual Petroleum Storage Terminals

a. Haiphong Storage Terminal -- Bombed 29 June and 7 July

Examination of post-strike photography of the 29 June raid (see the photograph) indicates that almost one-half of the pre-strike capacity of 72,000 tons had been destroyed or damaged. Field interpretation of photography of the strike of 7 July suggests that no substantial additional damage to tankage was inflicted. Support buildings were damaged in both attacks, and the later bombing reportedly destroyed the main pumphouse. The three oil jetties remain undamaged. Despite the loss of the pumphouse, the facility probably could accept cargoes via the jetties by using the pumps aboard a tanker or barge. Transferring petroleum within and out of the terminal, however, will require substitute piping arrangements and pumps. There is no evidence of damage to the rail sidings which serve the terminal.

b. Hanoi Storage Terminal -- Bombed 29 June

Examination of photography of 30 June indicates that the Hanoi storage terminal -- the most valuable storage and distribution hub in North Vietnam -- was completely destroyed or irreparably damaged (see the photograph). Although some of the tanks appear to be still standing, evidence of buckling of steel plates and other damage from fire and shrapnel indicates that none can be used or repaired. Support buildings -- warehouses, pumphouses, drum-filling sheds, maintenance shops, and administration buildings -- have been destroyed or severely damaged. The rail spur used for box cars (presumably to move petroleum drums in and out of the terminal) and some rolling stock have been damaged. The rail spur used for tank cars and the tank car loading rack have been destroyed.

Restoration of the Hanoi terminal would require complete reconstruction, including removal of debris, cleaning of the site, preparation of bases for new tanks, and, most important, resupply of tank steel, pipes, fittings, and pumps. Such materials and equipment probably would have to come from the USSR.

c. Nguyen Khe -- Bombed 30 June

Good post-strike photography confirms pilot reports that the only damage to this terminal was the destruction of one tank, which probably was empty (see the photograph). Three large steel tanks enclosed by concrete sheathing, and nine large buried tanks, remain

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undamaged. Except for the one tank that was destroyed, this terminal probably is usable at its pre-strike capacity.

d. Bac Giang Storage Terminal -- Bombed 30 June

Usable post-strike photography of this site was not available on 8 July. The fire and smoke in available photography tends to confirm a pilot report of destruction or damage to at least 40 percent of the tankage. The fact that approximately 21 bombs fell in the target area suggests that extensive damage probably was inflicted on the buildings and piping within the compound. The small oil jetty which serves the terminal appears to be undamaged.

e. Do Son Storage Terminal -- Bombed 30 June and 3 July

No usable post-strike photography of this small facility, which consisted essentially of only two tanks, is available. Reports of the bombing indicate direct hits on both tanks but no evidence of any explosions or fire. We accept these reports as accurate and consider the capacity at Do Son to be unusable, but can make no estimate of the possible loss of petroleum products or of the recuperability of the site.

f. Viet Tri Storage Terminal -- Bombed 30 June

There was no damage to the storage tanks.

g. Duong Nham Storage Terminal -- Bombed 1 July

No post-strike photography is available of this site. A pilot report of 6 July indicates that there was no apparent damage to the tanks but that support buildings were destroyed or damaged severely.

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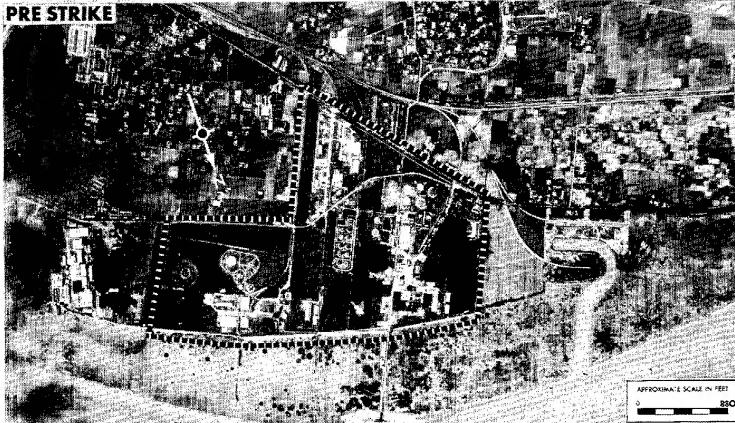
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NORTH VIETNAM

HAI PHONG POL STORAGE

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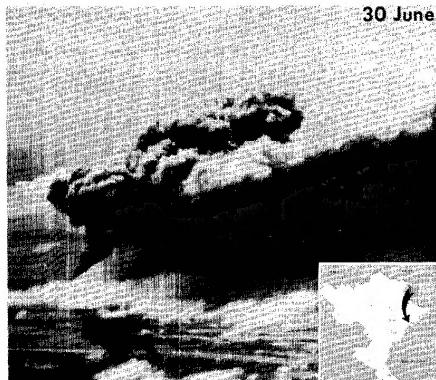
PRE STRIKE



CUA CAM

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MSN: UE 932 A DATE: 30 JUNE 66 FRM: PAN

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POST STRIKE



29 June



2 July

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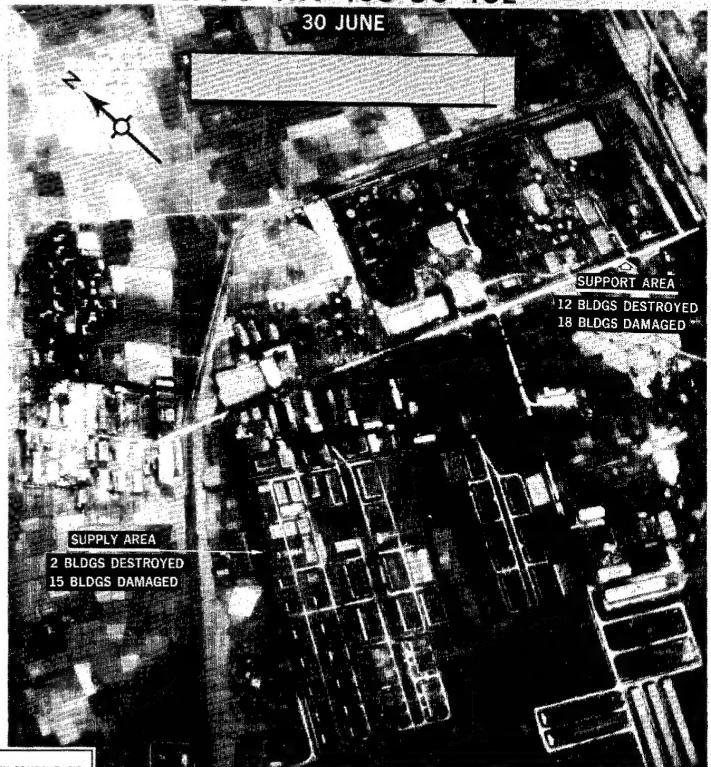


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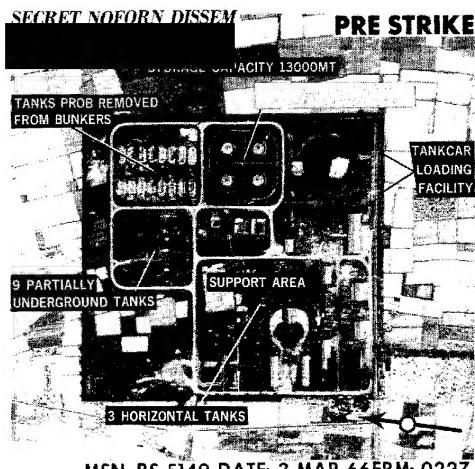


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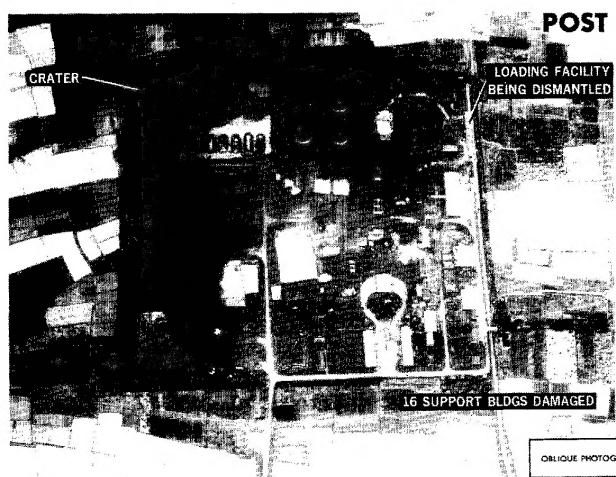
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